

MESSRS. MACMILLAN AND CO. will publish next week the Essex Field Club Report on the East Anglian Earthquake of April 22, 1884. This Report has been drawn up by Prof. Raphael Meldola and Mr. William White, and will contain maps and several illustrations.

THE jubilee volume of the Statistical Society will shortly be published by Mr. Stanford, of Charing Cross. It will contain the proceedings of the jubilee meeting of the Society held in June last, and will comprise valuable papers by the President, Sir Rawson W. Rawson, Dr. F. J. Mouat, M. Levasseur, and Prof. Neumann-Spallart, at whose initiation the International Statistical Institute was then founded.

FRESH earthquake shocks have been felt in the district round M'sila during the last week and principally on Saturday, December 12. They have also been felt at Bordj-ban-arerdj and Setif. The new road from Setif to Bordj has been cut by rocks falling from the surrounding mountains. A bridge has been destroyed and a railway station demolished. It is impossible up to this time to state whether the commotion originated in the Atlas or in the Hodna region, where M'sila is placed, not far from a large Sebbha, which, although almost dry in summer-time, contains a large quantity of water in rainy periods. Official documents will be sent to the Paris Academy of Sciences as soon as collected, but it is feared they will lack precision; no seismograph, so far as our knowledge goes, having been established in Algiers.

ADVICES from Smyrna in Asia Minor to November 25 state that a series of earthquakes, commencing on the 13th, had up to that time been felt at Denizlu in the interior, about 200 miles to the east. These disturbances were slight, but accompanied with subterranean noises.

WE are glad to see that the extremely valuable meteorological observations which were made at Sagastyr, the Arctic Station in the Delta of the Lena, during the years 1882 to 1884, are already being published. The last issue of the *Izvestia* of the Russian Geographical Society contains a preliminary report, by M. Yurgens, and several meteorological tables, namely, the observations in full, from September 1, 1882, to September 1, 1883, of the barometer, temperature of the air, of the surface of the soil and of the snow, and of the soil at a depth of 1 metre, the relative humidity, force of wind, and nebulosity; and the monthly averages of the above for each hour of the day. The magnetical observations for the same period are being calculated, as also those for 1883 and 1884. The whole, together with observations of the temperature of the soil at depths of 80 and 160 centimetres, temperature and density of water, tides, and auroræ will be published in a separate form. A map of the Delta of the Lena, based on new surveys, and a plan of the station accompany the report of M. Yurgens, which is very interesting, as it contains many details as to the life at the station, and varied information as to the Delta, and the excursions made during both summers. It is worthy of notice that the meteorologists of the station, although lost amidst tundras in the 73rd degree of latitude, were not so secluded from the world as might have been supposed. They received letters regularly from Yakutsk, together with newspapers and reviews, which reached them four months after their publication at St. Petersburg—a delay which is not so great if it be taken into account that letters take nearly one month to reach Irkutsk, the capital of Eastern Siberia. As to the frozen mammoth whose remains were explored by Dr. Bunge, only pieces of bones and traces of the contents of the stomach were found and brought to St. Petersburg.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus* ♀), two

Grey-breasted Parrakeets (*Bolborhynchus monachus*) from Monte Video, presented by H.R.H. the Prince of Wales, K.G.; two West Indian Agoutis (*Dasyprocta cristata*) from West Indies, presented by T.R.H. Prince Albert Victor and Prince George Frederick of Wales; a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. Jan Smidt; a Pig-tailed Monkey (*Macacus nemestrinus*) from Java, presented by Miss Ethel Rodger; two Tigers (*Felis tigris*) from Hyderabad, presented by the Nawab Salar Jungh Bahadur; a Cheetah (*Cynelurus jubatus*) from Afghanistan, presented by the Nawab Mahomed Hassan Ali Khan; a Tiger (*Felis tigris*).

OUR ASTRONOMICAL COLUMN

BRIGHT LINES IN STELLAR SPECTRA.—Mr. O. T. Sherman has continued his researches on the spectra of γ Cassiopeiæ and α β Lyræ, and announces in the *American Journal of Science* for December the discovery of no fewer than fifteen in the spectrum of the former star, and seventeen in that of the latter. The lines seen in γ Cassiopeiæ are as follows:—H α , λ 6356, 6160, D β , λ 5840, 5557.5, 5422, 5309.8, 5167.5, 4990, H β , λ 4623, H γ , λ 4180, and H δ , bright lines; and λ 6280, 5760, 5020, 4920, 4673.5, and 3993, dark lines. The bright lines agree closely in position with the principal lines observed by Prof. Young in the spectrum of the chromosphere.

Mr. Sherman has also examined a large number of other stars, and "in each case many or few bright lines have been seen, lines, so far as I know, formerly unsuspected." It is clear, if Mr. Sherman's observations can be satisfactorily confirmed, that we have here a most important discovery; but looking to the fact that these stars have probably been frequently observed by experienced spectroscopists without any bright lines being detected in them, whilst a false appearance of bright lines is readily produced in stellar spectra under certain circumstances, it would appear hazardous to accept Mr. Sherman's result without further evidence.

PHOTOMETRY OF THE PLEIADES.—A valuable memoir (*Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg*, vii. série, tome xxxii. No. 6) by Herr Ed. Lindemann of Pulkowa, "On the Magnitudes of Bessel's Stars in the Pleiades," has recently reached us. A special point of interest lies in the fact that Profs. Pickering and Pritchard have likewise determined the brightness of many of these stars with their respective photometers, each assuming the magnitude of Merope, to which the other stars of the group are referred, as 4.22. Herr Lindemann has also adopted the same magnitude for Merope, which he has used as his standard star. He also employed, as reference stars, Celæno and Anon 32, the magnitudes of which he had determined to be 5.27 and 6.51 respectively. The stars, fifty-two in number, were each observed on two separate nights, only one star of the fifty-three observed by Bessel proving too faint for Herr Lindemann's telescope of five inches aperture. Comparing his own results with those of Profs. Pickering and Pritchard, Herr Lindemann finds, on the whole, a very gratifying agreement; twenty-five stars observed by Prof. Pickering showing a mean excess over the Pulkowa observations of 0.04 of a magnitude, and thirty-three stars observed by Prof. Pritchard giving a mean excess of 0.05. Prof. Pritchard's later observations give a yet smaller difference, viz. 0.01 of a magnitude. When it is remembered that the three photometers employed—Herr Lindemann using a Zöllner photometer—differed entirely in principle, construction, and method of employment, this close agreement would seem to indicate that each may be relied upon with very considerable confidence, when the differences of stellar magnitude determined by their means are not very great. The stars Nos. 1, 4, 21, 31, and 33 would appear to be variable, and possibly two others likewise. Pogson's scale has been employed for the conversion of the logarithm of the light of the star into magnitude.

FABRY'S COMET.—The following elements and ephemeris have been computed for this comet by Dr. H. Oppenheim:—

Perihelion Passage, 1886 March 9.7944 Berlin M.T.

$$\begin{array}{r} \omega = 132^{\circ} 36' 19'' \\ \Omega = 32^{\circ} 17' 32'' \\ i = 47^{\circ} 18' 0'' \\ \log. q = 9.69654 \end{array} \quad \text{Mean Eq. 1885 } \circ$$

Errors of the middle observation :—

$$\delta \lambda = -8'' \quad \delta \beta = -2''.$$

Ephemeris for Berlin Midnight

1885	App. R.A.	App. Decl.	Log. Δ	Brightness
	h. m. s.			
Dec. 20 ...	23 59 57 ...	+20 43'1 ...	0.0837 ...	1.4
22 ...	56 49 ...	44'3 ...		
24 ...	53 52 ...	46'2 ...	0.0844 ...	1.5
26 ...	51 5 ...	49'0 ...		
28 ...	48 29 ...	52'6 ...	0.0849 ...	1.6

The brightness on December 1 is taken as unity. The above elements differ considerably from those published by Dr. S. Oppenheim in the *Vienna Circular*, No. lvi., but appear to represent the observations better.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, DECEMBER 20-26

(For the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on December 20

Sun rises, 8h. 5m.; souths, 11h. 57m. 59.2s.; sets, 15h. 50m.; decl. on meridian, 23° 27' S.; Sidereal Time at Sunset, 21h. 48m.

Moon (Full on Dec. 21) rises, 15h. 17m.; souths, 23h. 5m.; sets, 6h. 58m.*; decl. on meridian, 17° 48' N.

Planet	Rises	Souths	Sets	Decl. on meridian
	h. m.	h. m.	h. m.	
Mercury ...	7 36 ...	11 45 ...	15 54 ...	20° 58' S.
Venus ...	10 47 ...	15 17 ...	19 47 ...	17 41' S.
Mars ...	22 46* ...	5 25 ...	12 4 ...	7 2' N.
Jupiter ...	0 22 ...	6 23 ...	12 24 ...	0 38' S.
Saturn ...	16 19* ...	0 28 ...	8 37 ...	22 29' N.

* Indicates that the rising is that of the preceding and the setting that of the following day.

Occultations of Stars by the Moon

Dec.	Star	Mag.	Disap.	Reap.	Corresponding angles from vertex to right for inverted image
			h. m.	h. m.	° ' "
20 ...	γ Tauri ...	4 ...	4 11	near approach	44 —
20 ...	B.A.C. 1526 ...	6 ...	17 6	near approach	151 —
21 ...	111 Tauri ...	5½ ...	5 6 ...	5 56 ...	113 325
21 ...	117 Tauri ...	6 ...	6 35 ...	7 6 ...	77 353
21 ...	B.A.C. 1930 ...	6½ ...	17 46 ...	18 37 ...	38 253
25 ...	ξ Leonis ...	6 ...	3 55 ...	5 5 ...	80 276
26 ...	48 Leonis ...	6 ...	6 50 ...	7 48 ...	123 258

Phenomena of Jupiter's Satellites

Dec.	h. m.	Dec.	h. m.
21 ...	1 35 II. occ. reap.	22 ...	5 54 I. tr. egr.
21 ...	5 17 I. ecl. disap.	22 ...	6 30 III. occ. reap.
22 ...	1 34 III. ecl. reap.	23 ...	3 14 I. occ. reap.
22 ...	3 35 III. occ. disap.	24 ...	0 22 I. tr. egr.
22 ...	3 38 I. tr. ing.	26 ...	7 11 II. tr. ing.

The Occultations of Stars and Phenomena of Jupiter's Satellites are such as are visible at Greenwich.

Dec. h. m. Sun at greatest declination south; shortest day in northern latitude.

22 ... 5 ... Saturn in conjunction with and 3° 58' north of the Moon.

26 ... 11 ... Saturn in opposition to the Sun.

Variable Stars

Star	R.A.	Decl.	h. m.
	h. m. s.	° ' "	
β Lyrae ...	18 45 50 ...	33 13'8 N. ...	Dec. 25, 0 0 m
R Lyrae ...	18 51 50 ...	43 47'7 N. ...	26, m
χ Cygni ...	19 46 9 ...	32 37'4 N. ...	26, M
η Aquilæ ...	19 46 37 ...	0 42'7 N. ...	21, 17 0 M
δ Cephei ...	22 24 54 ...	57 49'6 N. ...	23, 4 0 M
"			26, 23 0 m
R Andromedæ ...	0 17 58 ...	37 56'4 N. ...	23, M
Algol ...	3 0 41 ...	40 30'7 N. ...	22, 3 51 m
"			25, 0 40 m
ζ Geminorum ...	6 57 17 ...	20 44'3 N. ...	23, 19 0 M
δ Libræ ...	14 54 50 ...	8 3'7 S. ...	22, 19 5 m
"			25, 2 56 m

M signifies maximum; m minimum.

Objects with Remarkable Spectra

Mr. O. T. Sherman, of Yale College Observatory, has recently called fresh attention to the spectra of γ Cassiopeiæ and β Lyrae, as he finds no fewer than seventeen bright lines in each. Both stars should therefore be examined as frequently and carefully as possible. β Lyrae is at minimum about midnight on Dec. 25.

There is an uncertainty about the ephemeris of R Andromedæ which renders observations of its brightness a matter of importance; its spectrum, whilst resembling in several particulars that of the third type, possessing so many special characteristics, that it deserves the most careful attention directly the star has attained a sufficient magnitude.

THE RETURN OF THE LEONIDS IN 1885

BETWEEN November 5 and 13 inclusive we had densely overcast skies, so that no observations could be obtained here.

On November 14 weather improved, but it was not until the morning of the 15th that the clouds completely dispersed and enabled that uninterrupted view of the firmament which is so necessary to the successful recording of meteors. The three following nights were also brilliantly clear, though the severe frosts which occurred rendered open-air watching somewhat trying. I have summarised my results for the four mornings as follows :—

Date, 1885	Time of obs. a.m.	Actual duration of obs. h.	Meteors seen	Leonids	Radiant point
Nov. 15	3½ to 6	2½ ...	24 ...	4 ...	149° + 21°
16	0½ to 3	2 ...	23 ...	0 ...	—
17	0½ to 4½	3½ ...	42 ...	6 ...	150° + 22°
18	2½ to 5½	2½ ...	25 ...	1 ...	—

Nov. 15-18... 0½ to 6 ... 10 ... 114 ... 11 ... 149½ + 21½

Making certain allowances for the intervals occupied in registering the paths, &c., meteors fell at the rate of about 14 per hour for one observer. Of the total number seen 11 only belonged to the special shower of Leonids. The proportion of the latter to the meteors visible from all other streams was therefore as 1 to 10.4. Six of the Leonids appeared in Leo with much foreshortened tracks close to their radiant point, which admitted of very accurate determination. As usual, they left lines of phosphorescence which in several instances brightened most perceptibly about one or two seconds after the extinction of the nucleus. I have frequently noticed this after-glowing of the streaks which are so commonly generated by the swift meteors discharged from the radiants near the apex of the earth's way.

On the morning of the 15th the Leonid's furnished about two meteors per hour for one observer. On the 16th there was an apparent lull in the display, not one being observed. On the 17th there was a very distinct reappearance of the shower with the same relative intensity as on the 15th. On the 18th the shower had nearly become exhausted, for of 25 shooting-stars only one certainly could be assigned to the radiant in Leo.

It is extremely probable that the maximum took place, as it usually does, on the morning of the 14th, when unfortunately the sky was involved in clouds. But the observations now reported for the later nights of the display sufficiently prove there to have been a definite, though feeble, revival of the shower this year, and there can be no question that the Leonid meteor-orbit is continuous so far as our accumulating observations enable us to judge. Every November, as the earth crosses the node, meteors having the same radiant in the sickle of Leo are to be seen, and they exhibit all the characteristics typical of the Leonids during one of the major displays. There are doubtless some condensations in the orbit, giving rise to brighter showers in some years than in others, but a large number of further observations are required to determine the precise nature of these. There can be no doubt that there are certain occasions when fairly bright returns of these meteors pass wholly unobserved. Moonlight, cloudy weather, or the occurrence of a maximum in the daytime, may so much obliterate it as to induce entirely wrong impressions as to its comparative strength in successive years. We essentially require observers in widely different longitudes, and the continuity of annual records should be preserved as far as possible.